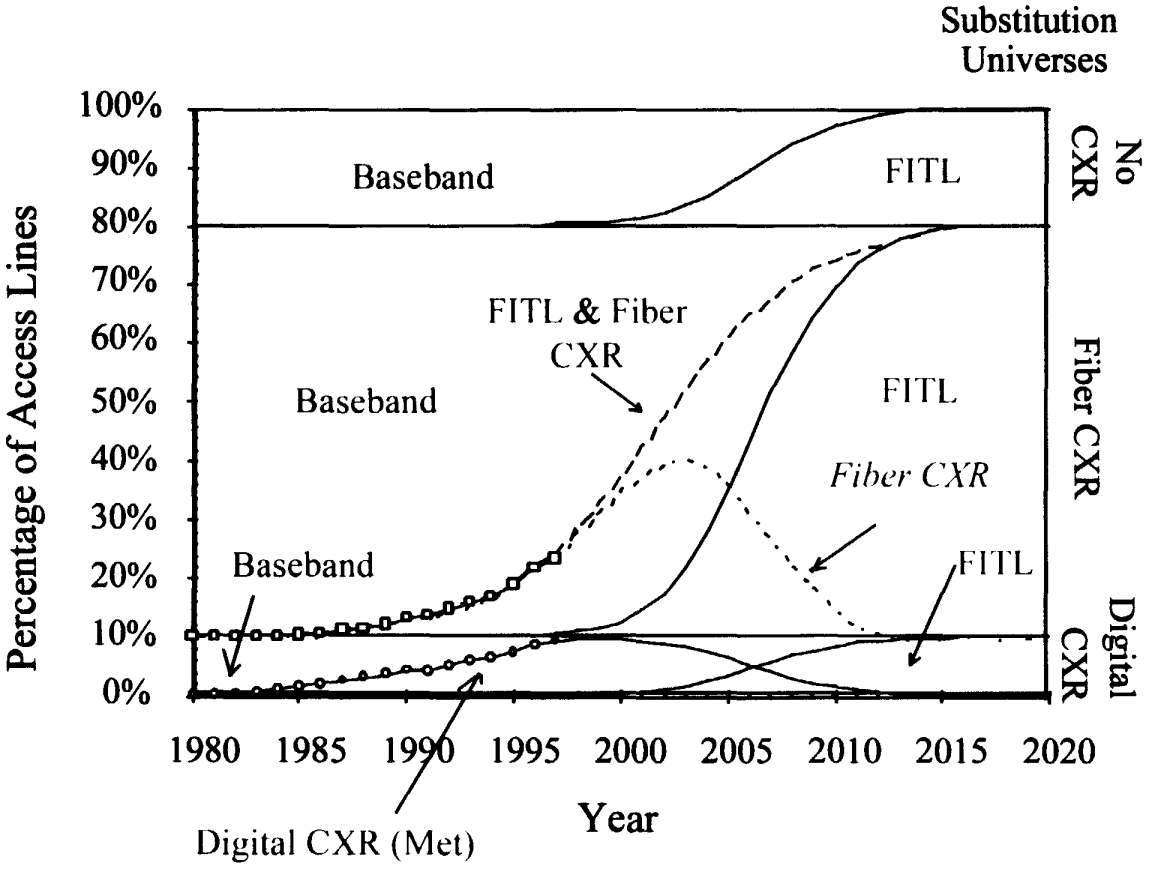
Multiple Substitution Analysis of Feeder Technologies



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Forecast for the Adoption of Fiber in the Distribution Outside Plant

An analysis of Internet access requirements and the role of fiber and xDSL technologies

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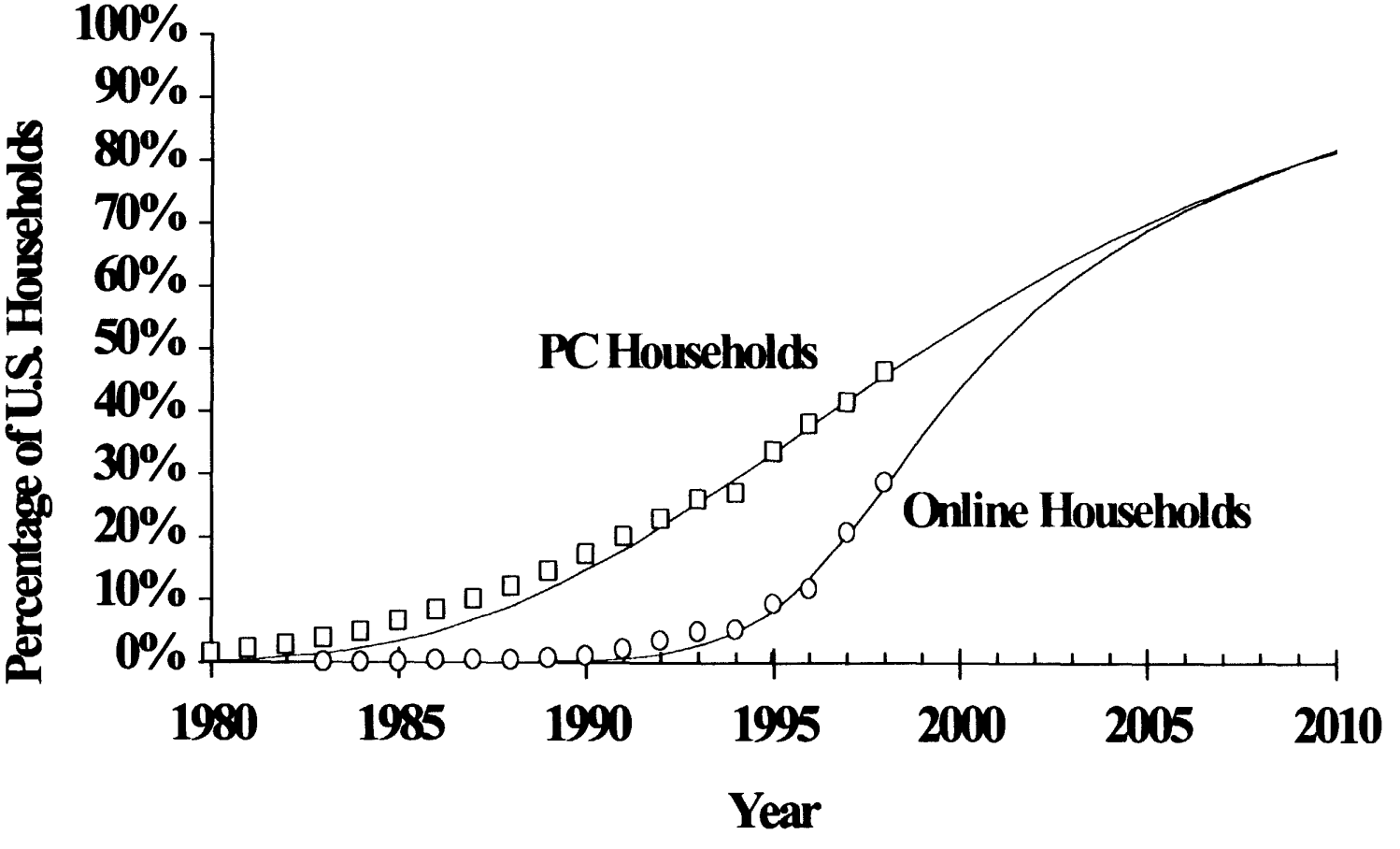
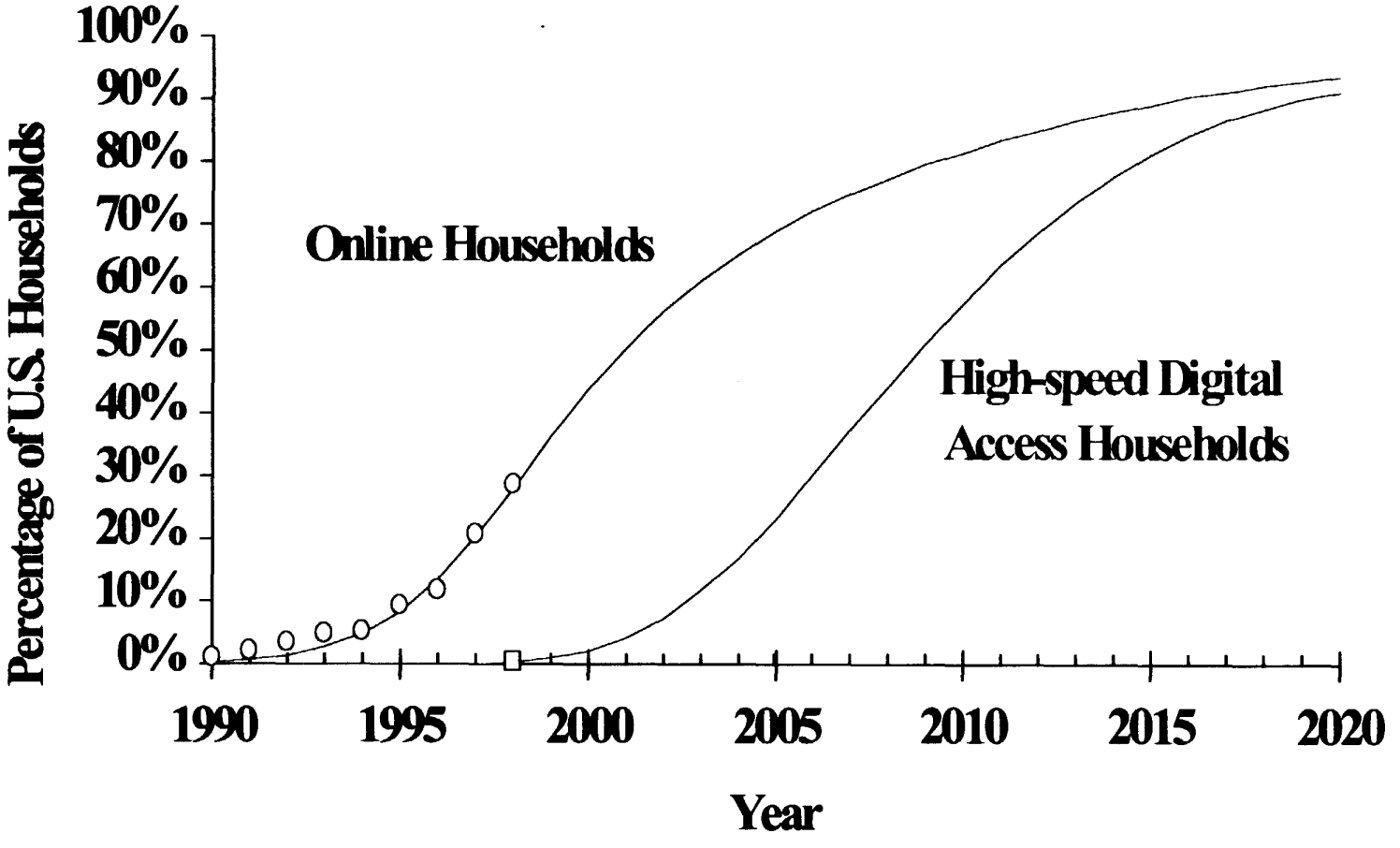
U.S. Adoption of Home PCs and Online Services



TECHNOLOGY FUTURES INC

U.S. Adoption of Online Services and High-Speed Digital Access



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Historical Analogies Used to Drive the Forecast of Home Digital Services Adoption

Analogy	Country	Range	b
Radio	U.S.	1922-1940	.1803
Color TV	U.S.	1955-1992	.1843
Television	U.S.	1946-1960	.3175
CD Player	U.S.	1986-1994	.1651
VCR	U.S.	1979-1994	.2337
Pay cable	U.S.	1973-1981	.2121
Average			**.2155**

"b" value implied by analogies .2155

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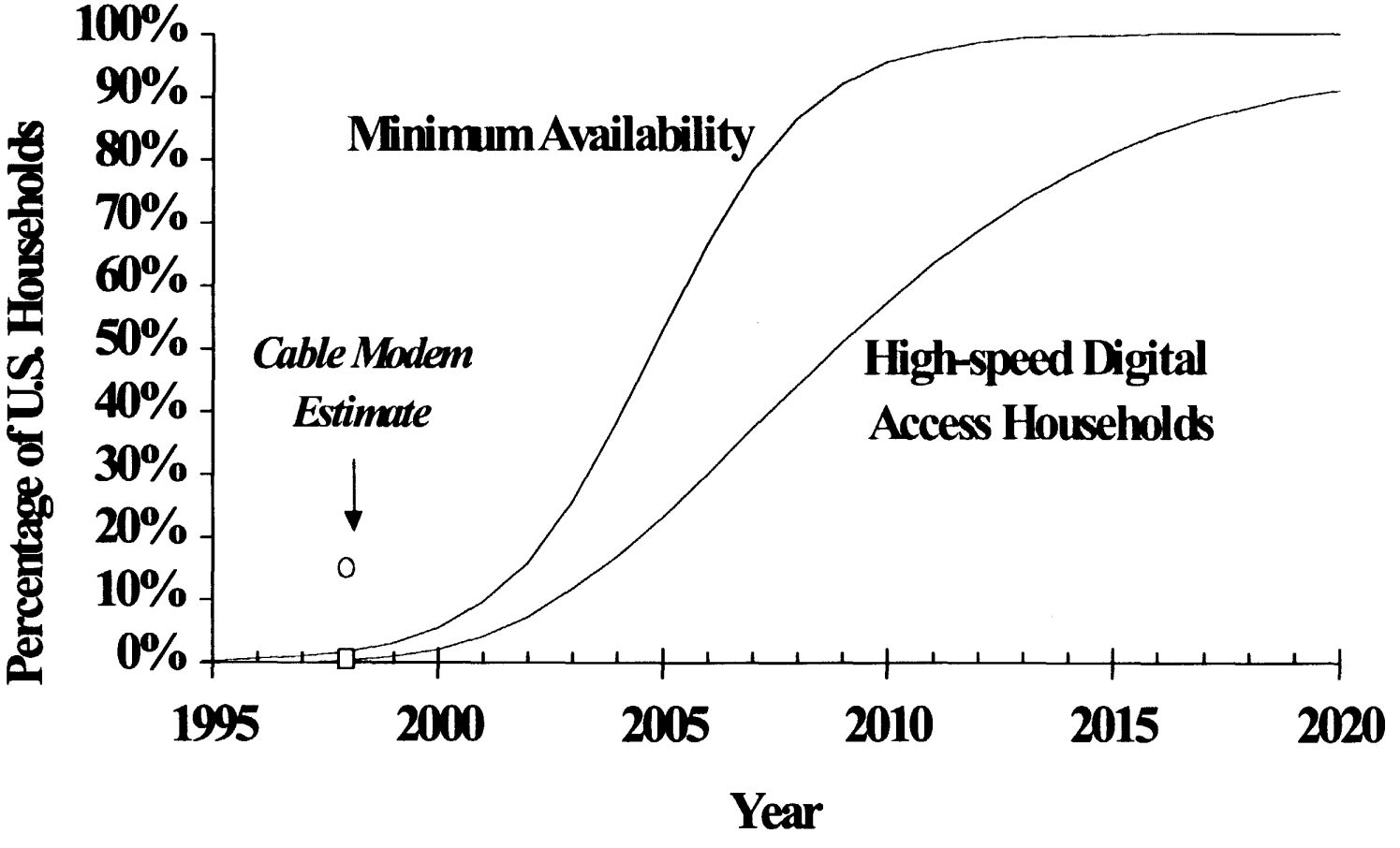
U.S. Minimum Availability & Adoption of High-Speed Digital Access



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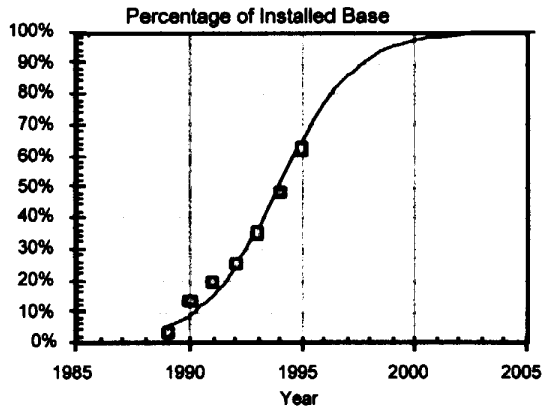
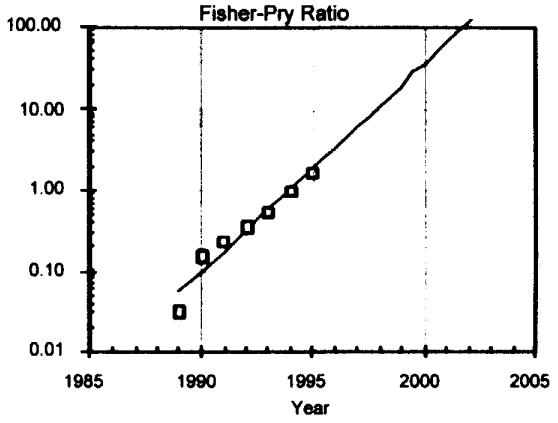
ISDN Availability—Percentage of Access Lines

Model	FP		
Input to Compute a & b:			
Year Rate		% New Span	
	1.Direct	*2.Comp*	*3.Fitted*
a=			1994
b=			0.5869
r=			80%
		Use Column->	3

Year	*Input* Pct New	*Data?* Exclude Yes=1	*Output* Pct New
1989	3.0%	0	5.2%
1990	13.2%	0	9.0%
1991	19.2%	0	15.0%
1992	25.8%	0	24.1%
1993	35.2%	0	36.4%
1994	48.5%	0	50.7%
1995	62.5%	0	64.9%
1996		0	76.9%
1997		0	85.7%
1998		0	91.5%
1999		0	95.1%
2000		0	97.2%
2001		0	98.4%
2002		0	99.1%
2003		0	99.5%
2004		0	99.7%
2005		0	99.8%
2006		0	99.9%
2007		0	100.0%
2008		0	100.0%
2009		0	100.0%
2010		0	100.0%
2011		0	100.0%
2012		0	100.0%
2013		0	100.0%
2014		0	100.0%
2015		0	100.0%
2016		0	100.0%
2017		0	100.0%
2018		0	100.0%
2019		0	100.0%





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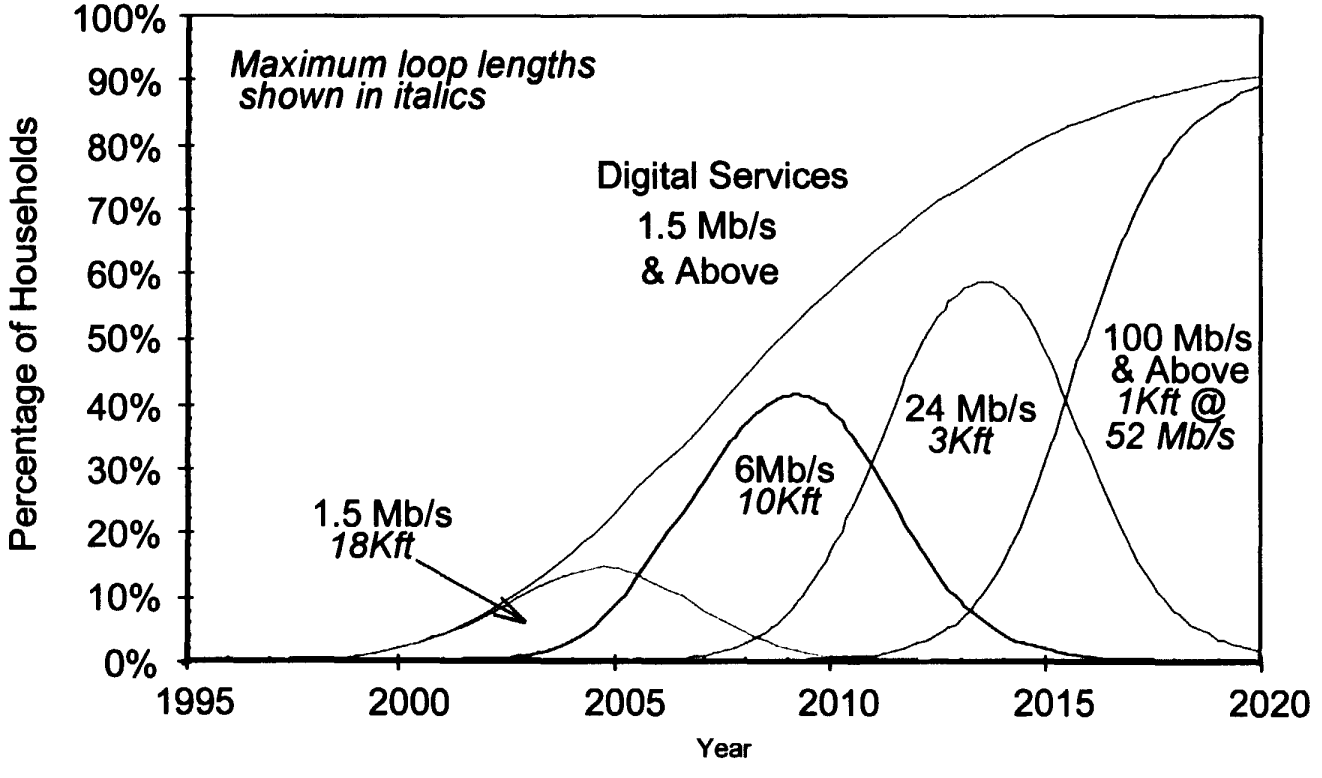
Households Using Digital Services—Minimum Competitive Data Rates



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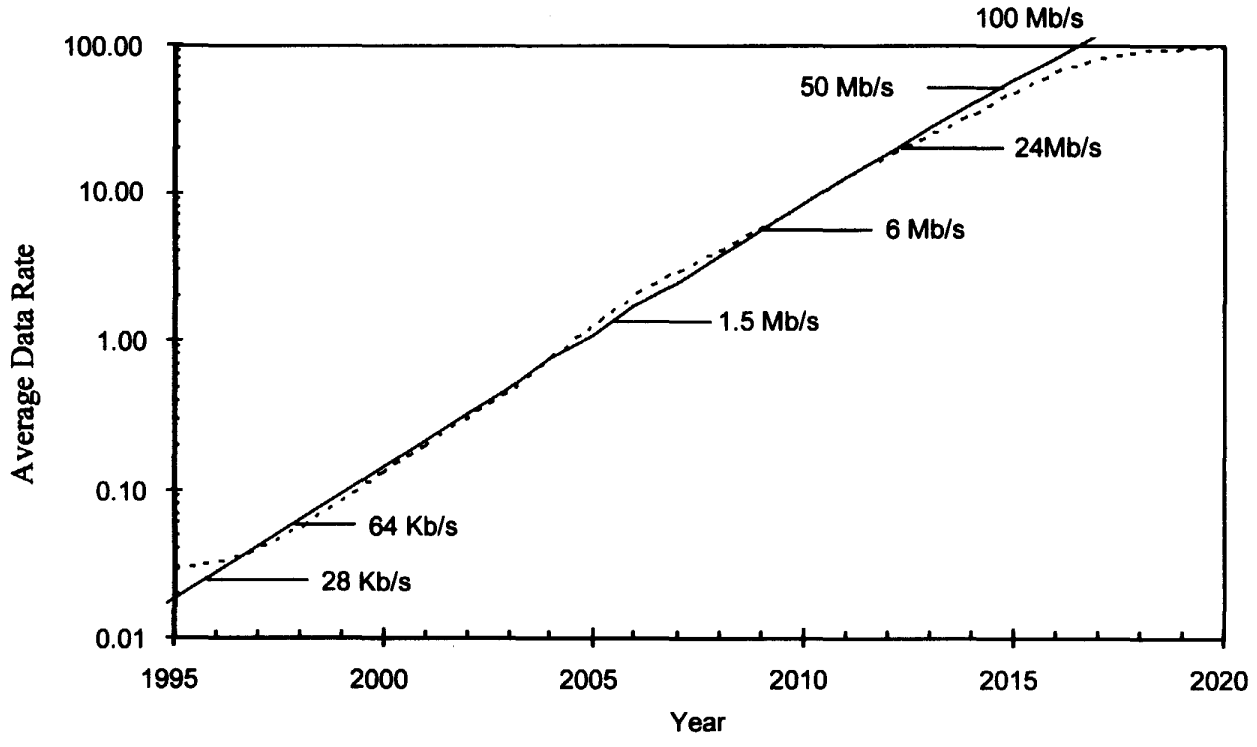
Home Digital Services—Average Data Rate



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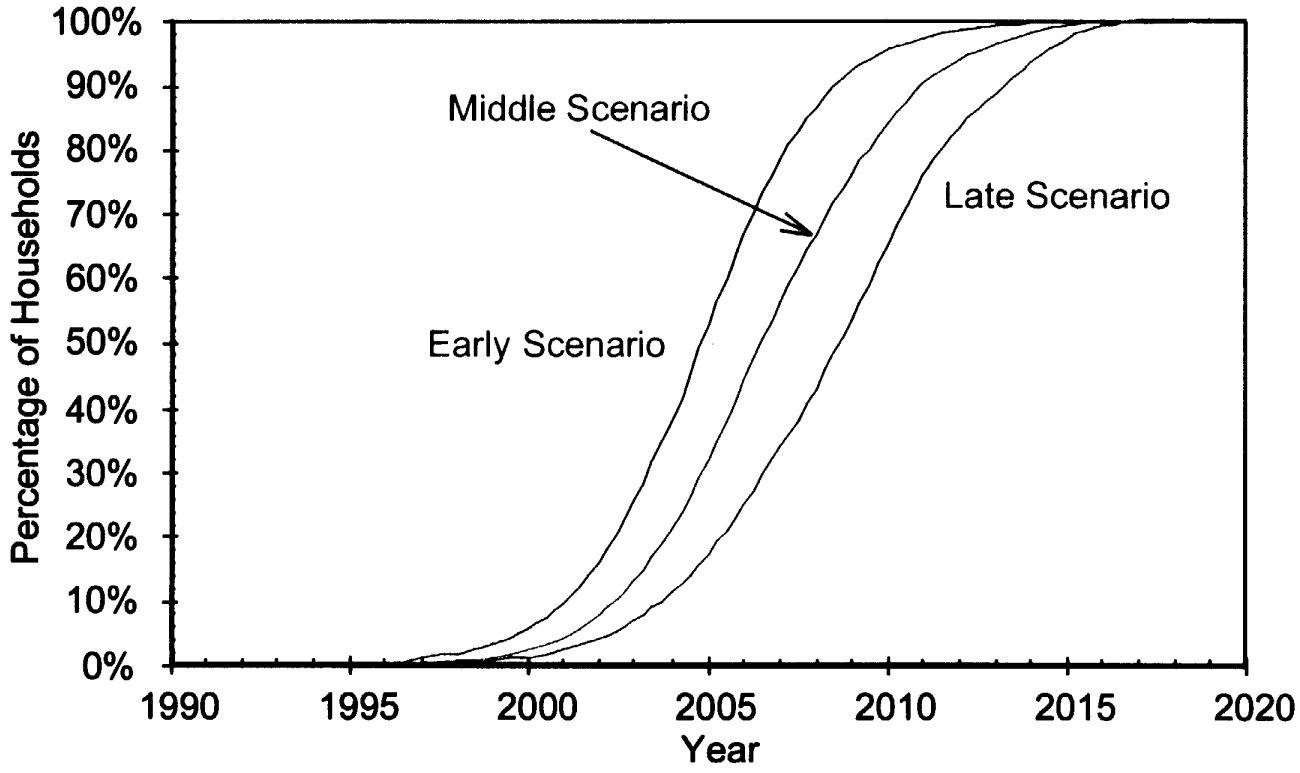
Home Digital Service Availability on Fiber



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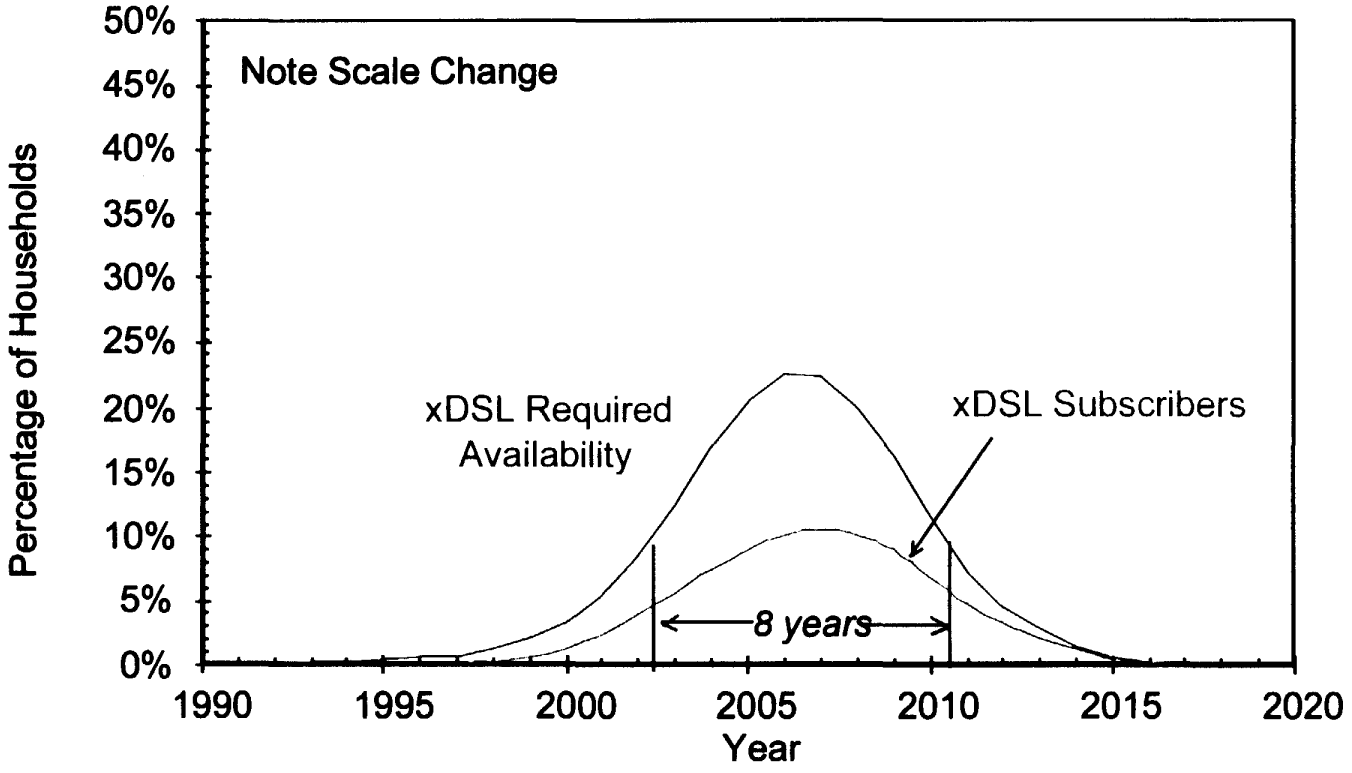
xDSL Households—Middle Scenario



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TLEN 97-3.21

Switching Technologies

1. Digital for Analog

2. Modular Digital Analysis

3. Packet vs. Circuit

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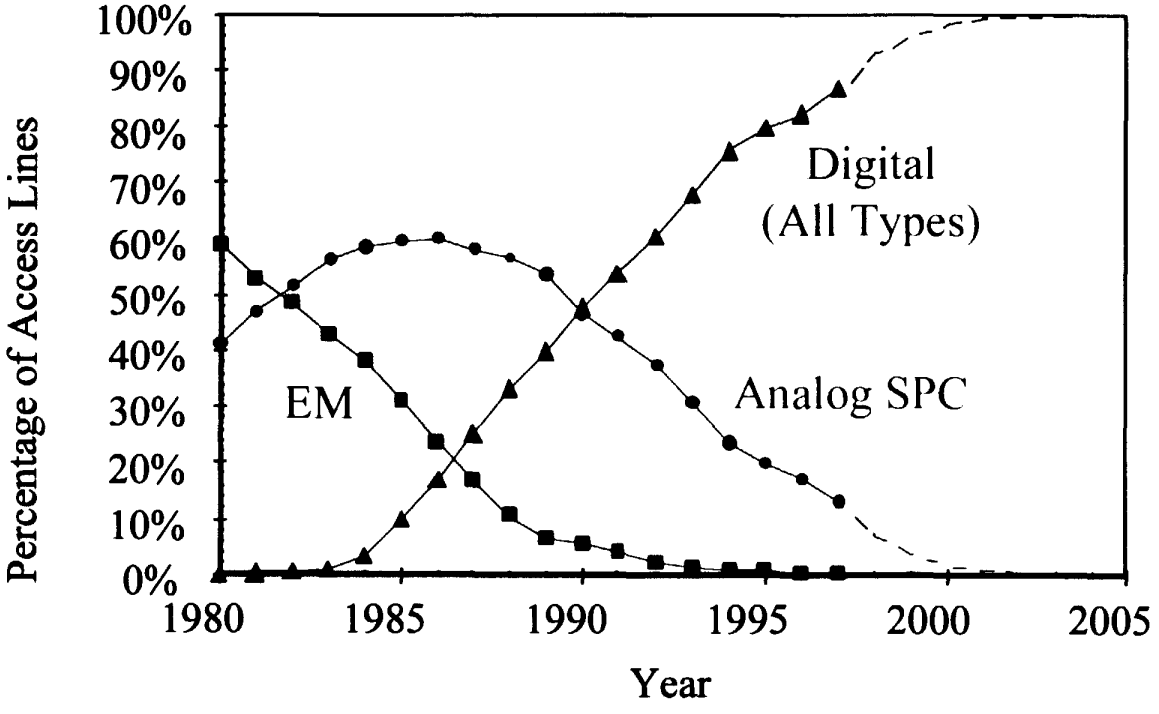
Switching Technology Shares



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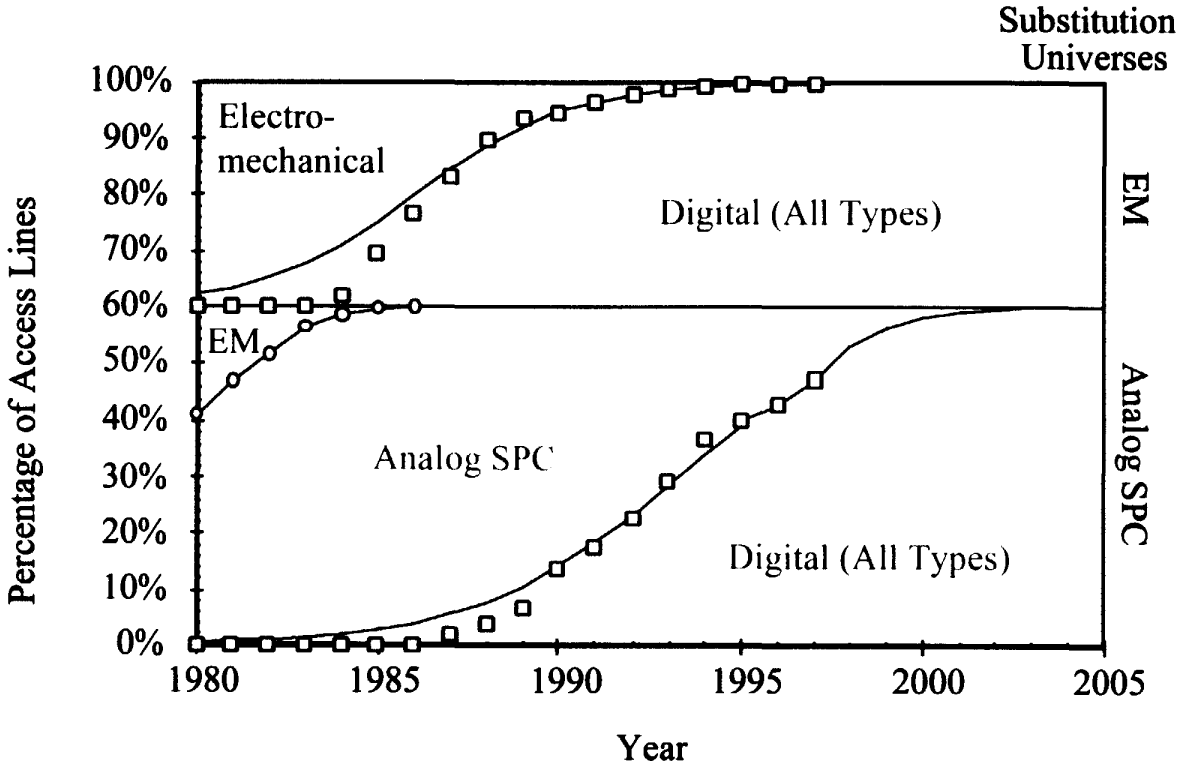
Multiple Substitution Analysis of Switching Technologies



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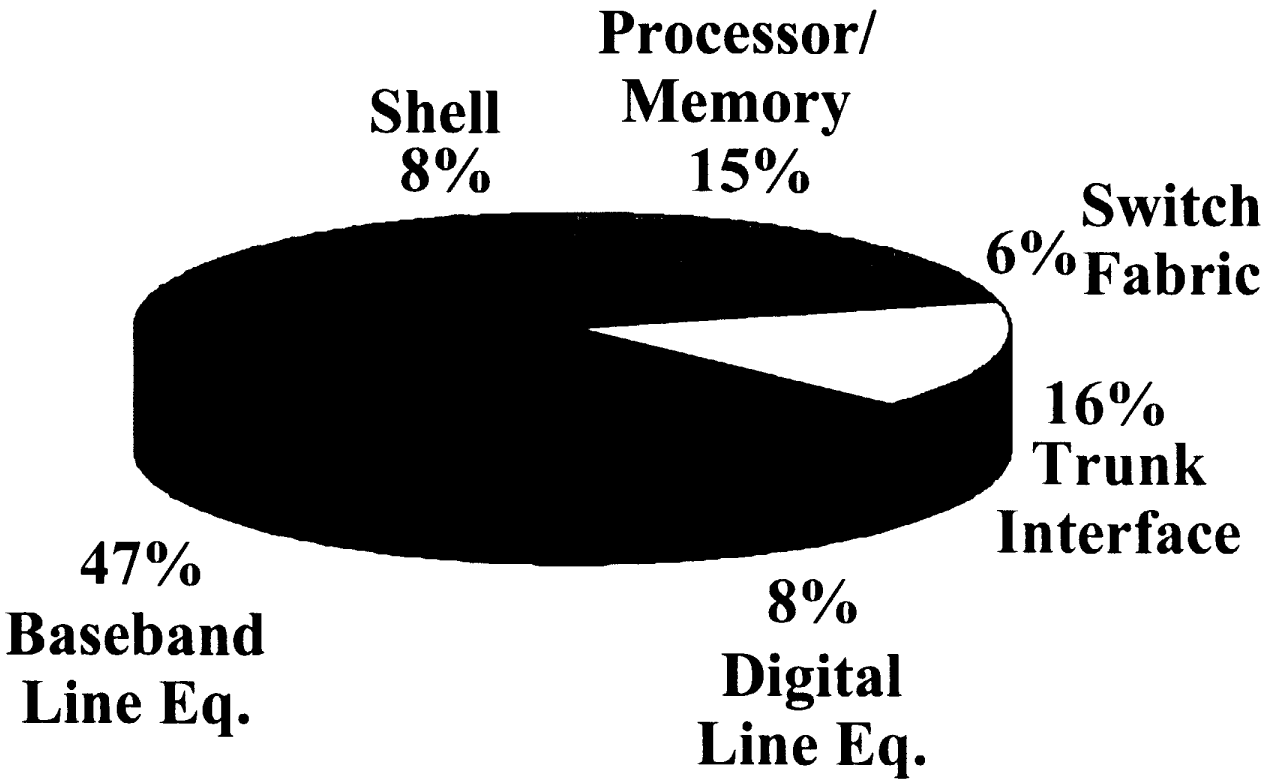
Digital Switching Investment



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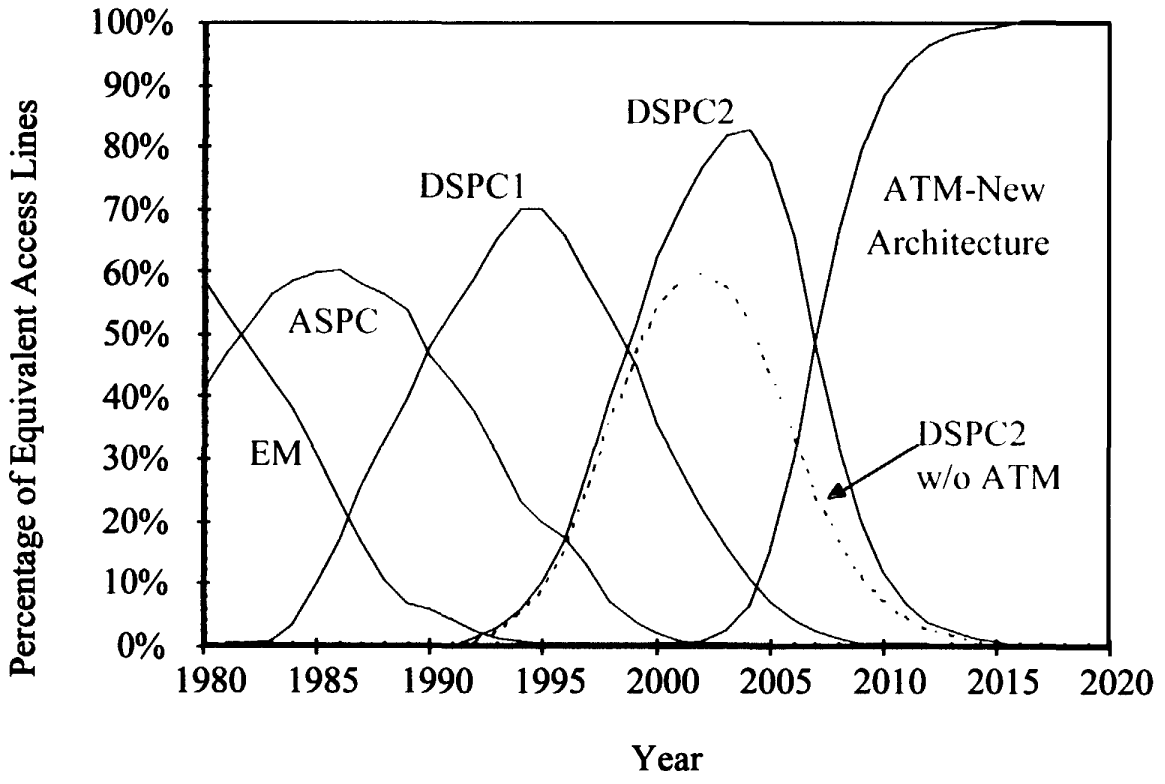
Switching Technology Shares—Late ATM Scenarios



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Digital Switching—Modular Retirement Analysis

Component	% of Investment	Key Drivers	ARL (years)	Composite Contribution (years)
Processor/ Memory	15%	Life cycle	3.5	0.52
Switching Fabric	6%	Life cycle & ATM	8.0	0.52
Trunk Interface	16%	IO SONET + 2 years	4.1	0.65
DLC Line Interface	8%	Feeder SONET + 2 years	6.6	0.50
Baseband Line Interface	47%	DLC, FITL, & Dig Services	6.9	3.25
Shell	8%	ATM Architecture	11.3	0.92
Composite	100%	Composite ARL = (as of 1/1/97)		6.3

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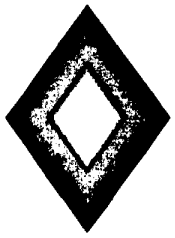

Packet vs. Circuit Switching

This is the subject for 1999 studies. These are not incorporated into current TFI life recommendations.

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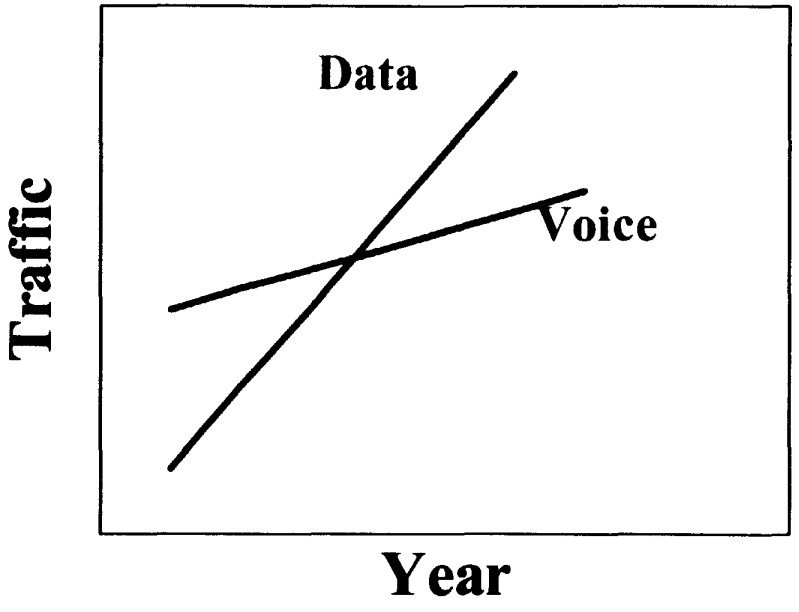
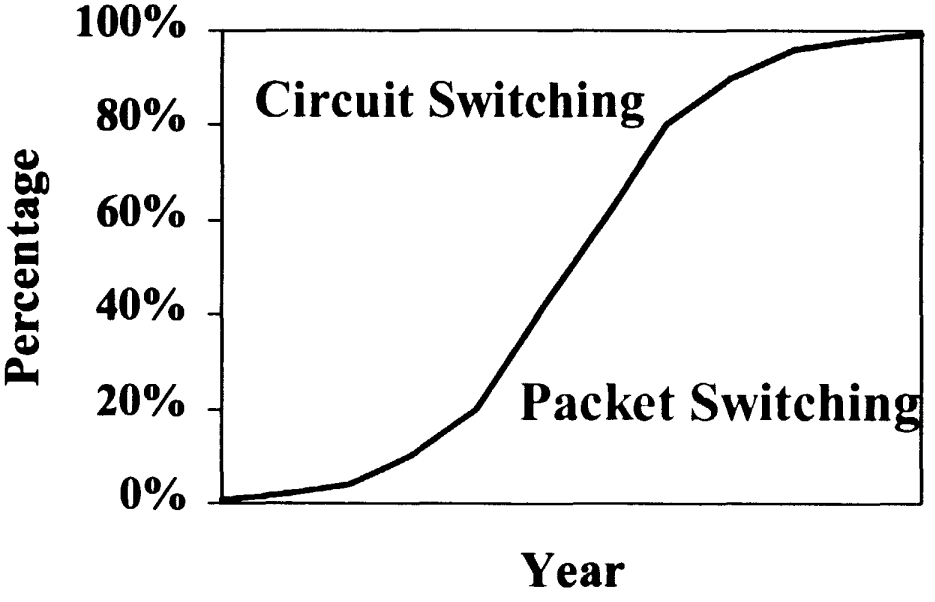
What's Going On?

Application Shift



Technology Substitution



Technological Competition

ATM vs. IP

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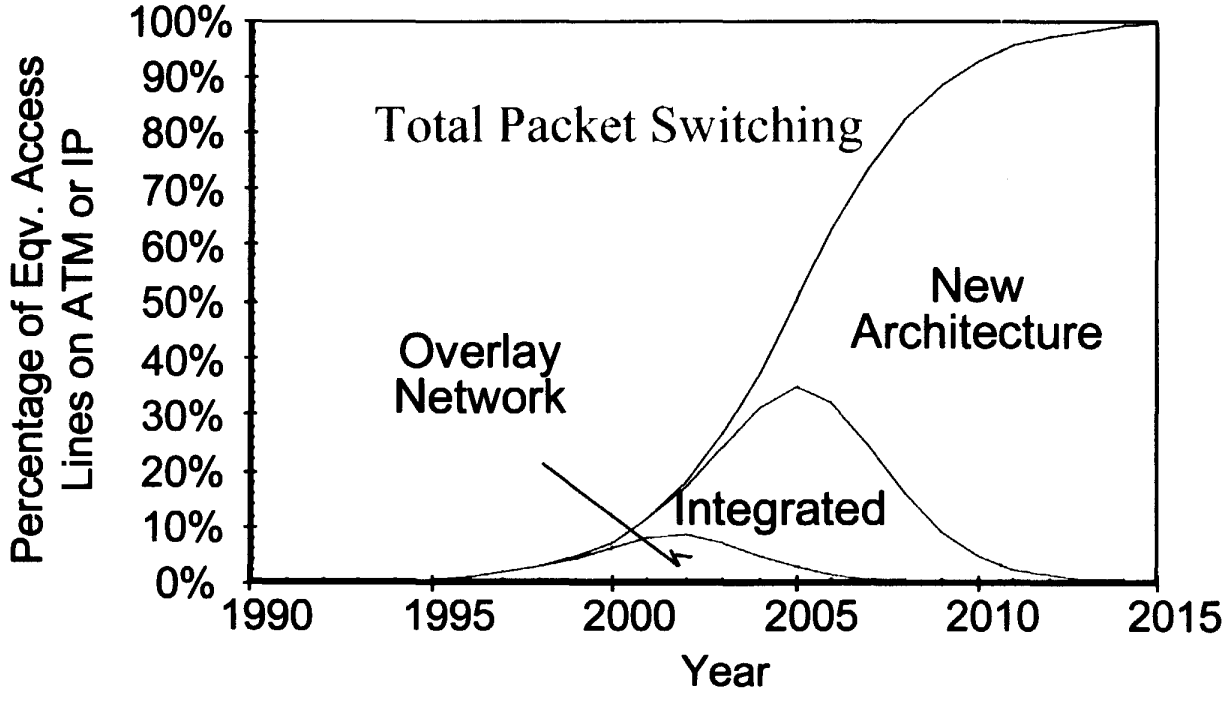
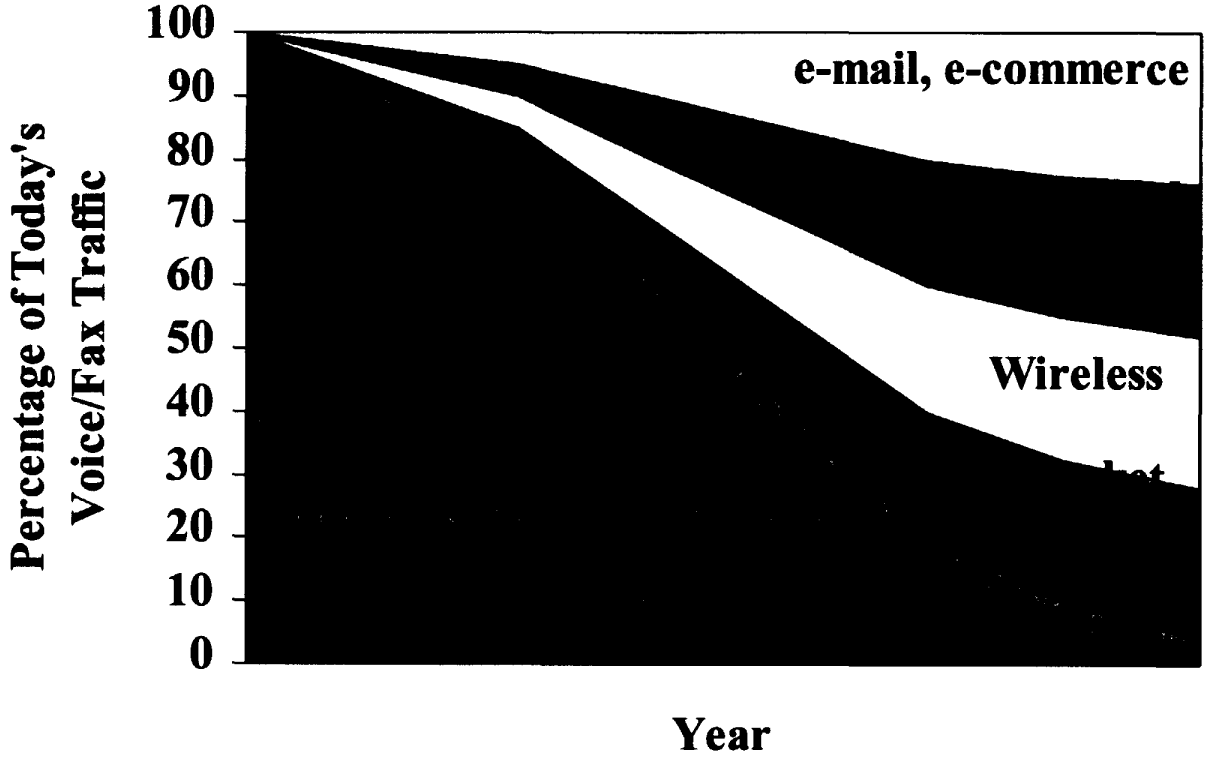
A Scenario for LEC Adoption of Packet Switching



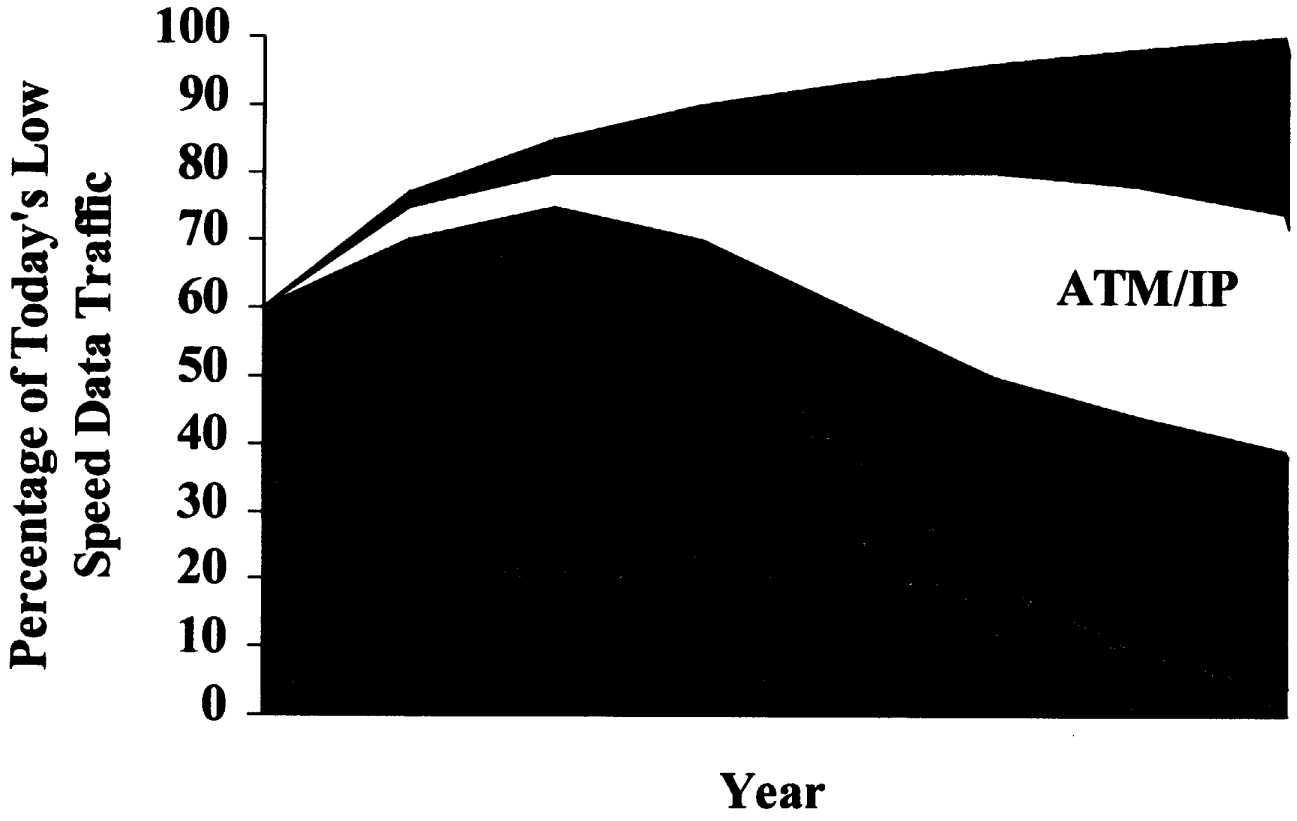
TECHNOLOGY FUTURES INC

Fate of Today's Circuit Switched Voice/Fax Traffic



TECHNOLOGY FUTURES INC

Fate of Today's Circuit Switched, Low-Speed Data Traffic



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Wireless vs. Wireline

An Economic Value Analysis

Note: This analysis is not incorporated into TFI industry recommended lives.

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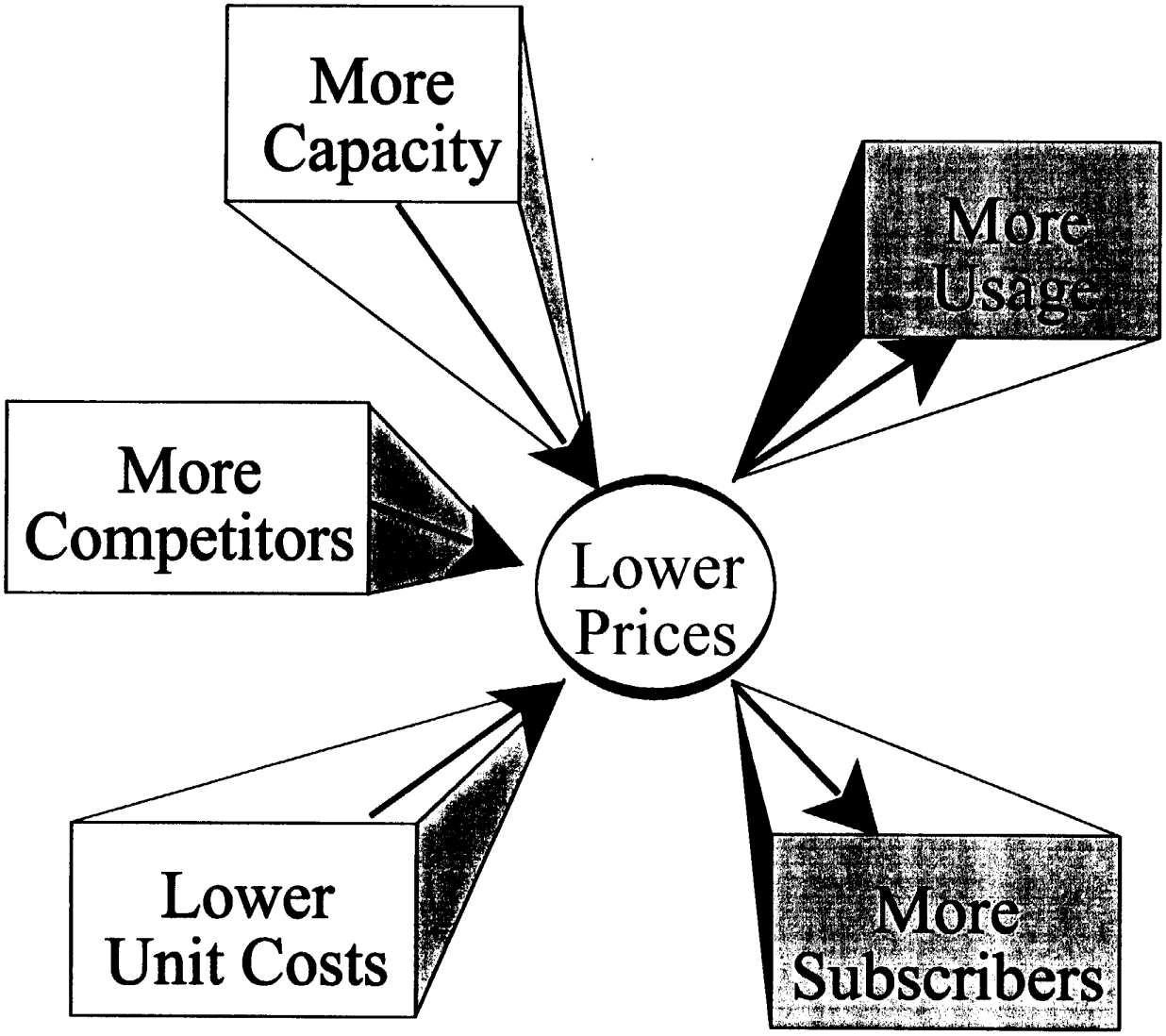

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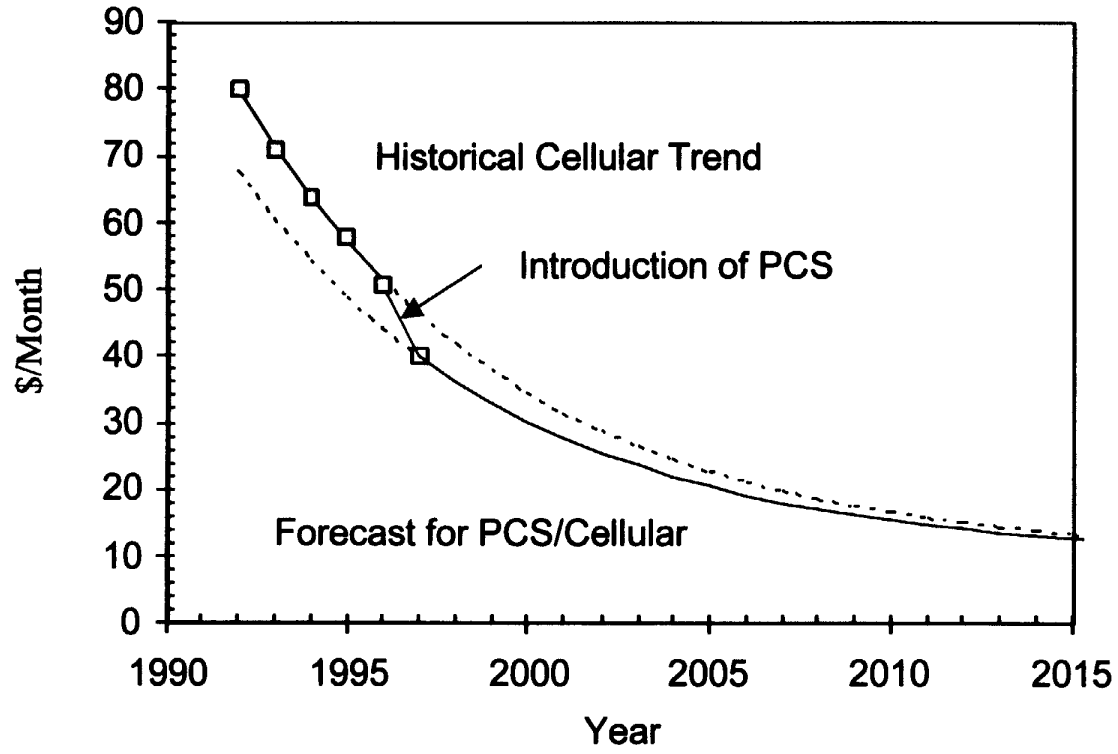
Monthly Price for U.S. Cellular/PCS Service (250 Mins)



Wireless Forecasts.xls 1~price

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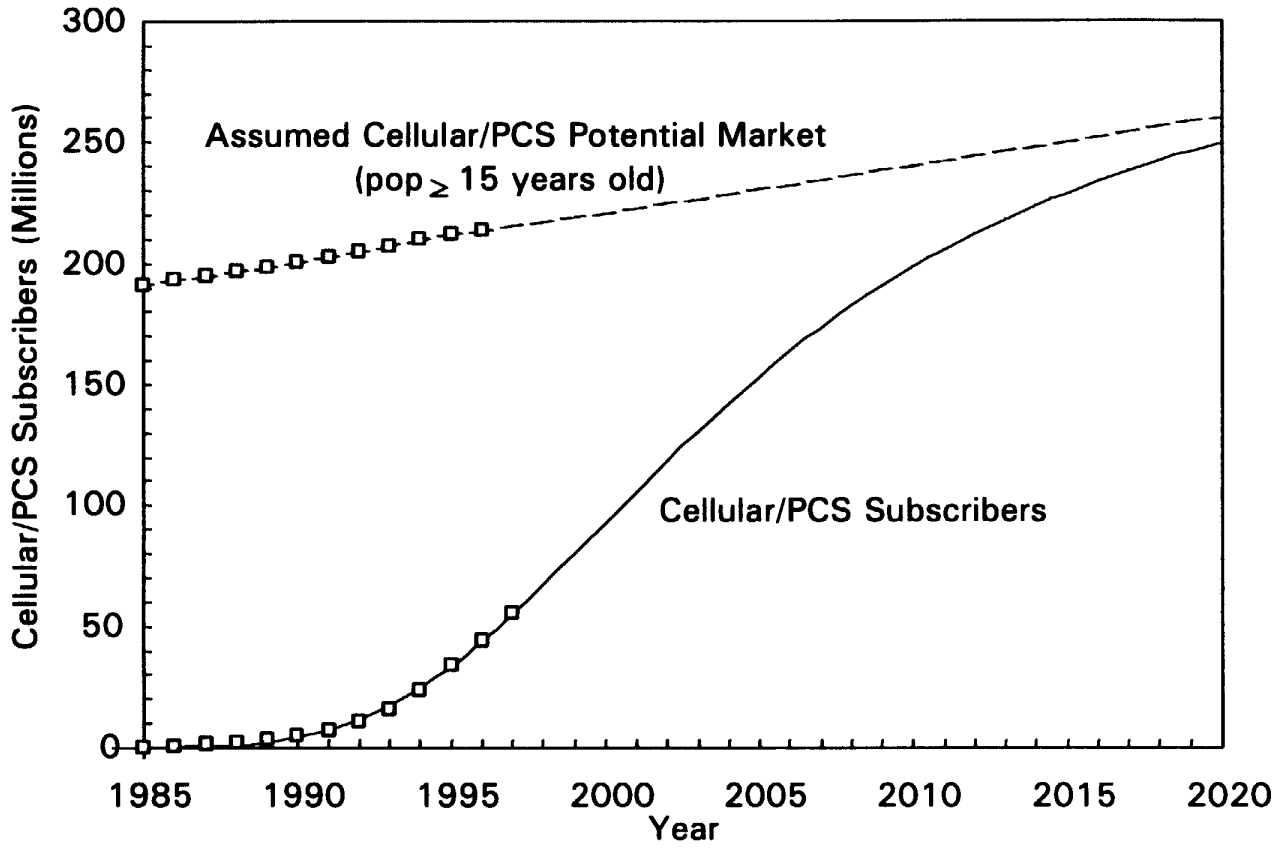
U.S. Cellular/PCS Subscribers



Source: Technology Futures, Inc.

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Why Wireless Can Replace Wireline for Voice and Low-Speed Data

- Less expensive
- Sufficient capacity
- Quality is improving
- Scalable for competition
- Mobility

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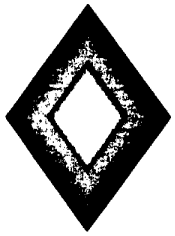

Wireless Options

- Traditional cellular/PCS
- Wireless local loop (cellular/PCS)
- Wireless local loop (fixed location)
- MMDS/LMDS
- LEOs (two generations)

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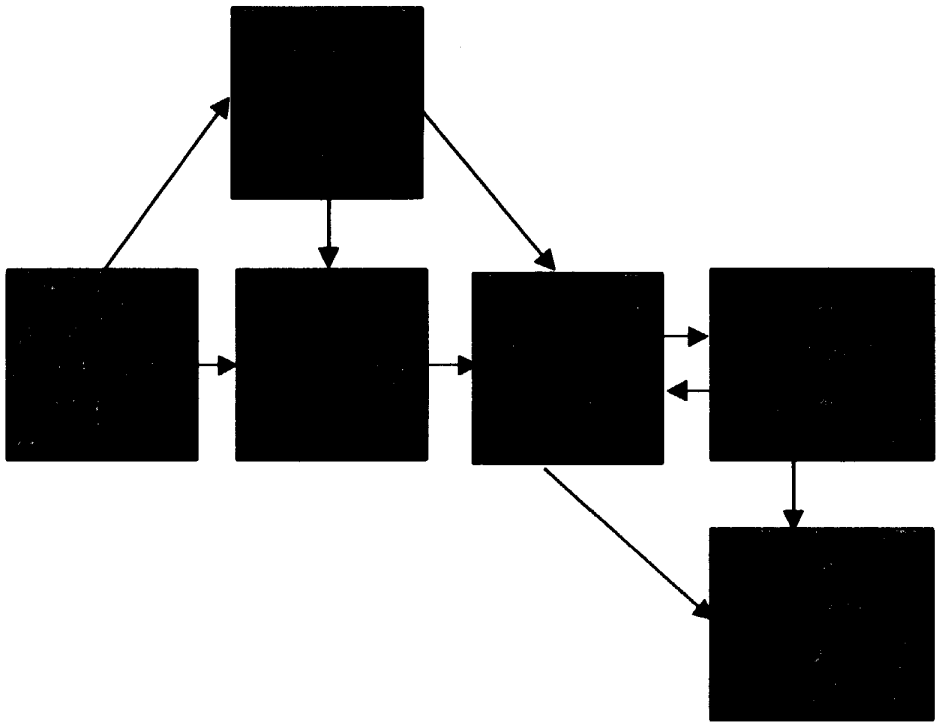
Calculating the Impact on Wireline

- Forecast of wireless access
- Calculation of lost wireline minutes and access
- Cash flow impact
- Loss of revenue

TECHNOLOGY FUTURES INC

Basic Model of Wireless/Wireline Competition

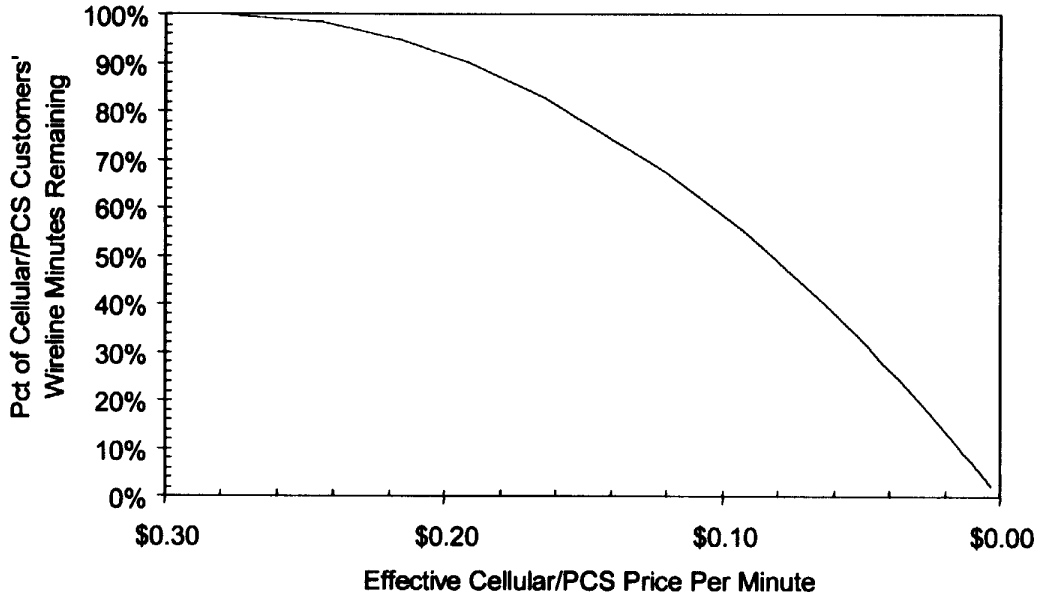


- Historically, high per-minute charges caused most customers to:
  - limit cellular usage
  - delay making calls when possible
  - limit length of calls
  - limit incoming calls
- At projected lower prices per minute, wireless will increasingly be used instead of wireline

Source: Technology Futures, Inc.

TECHNOLOGY FUTURES INC

Relationship Between Cellular/PCS Price and Wireline Usage



- Basic model
  - at $0.20 per minute, 90% of minutes remain on wireline
  - at $0.08 per minute, the remaining percentage falls below 50%
- No time lag

Source: Technology Futures, Inc. (Exhibit 3.3A)

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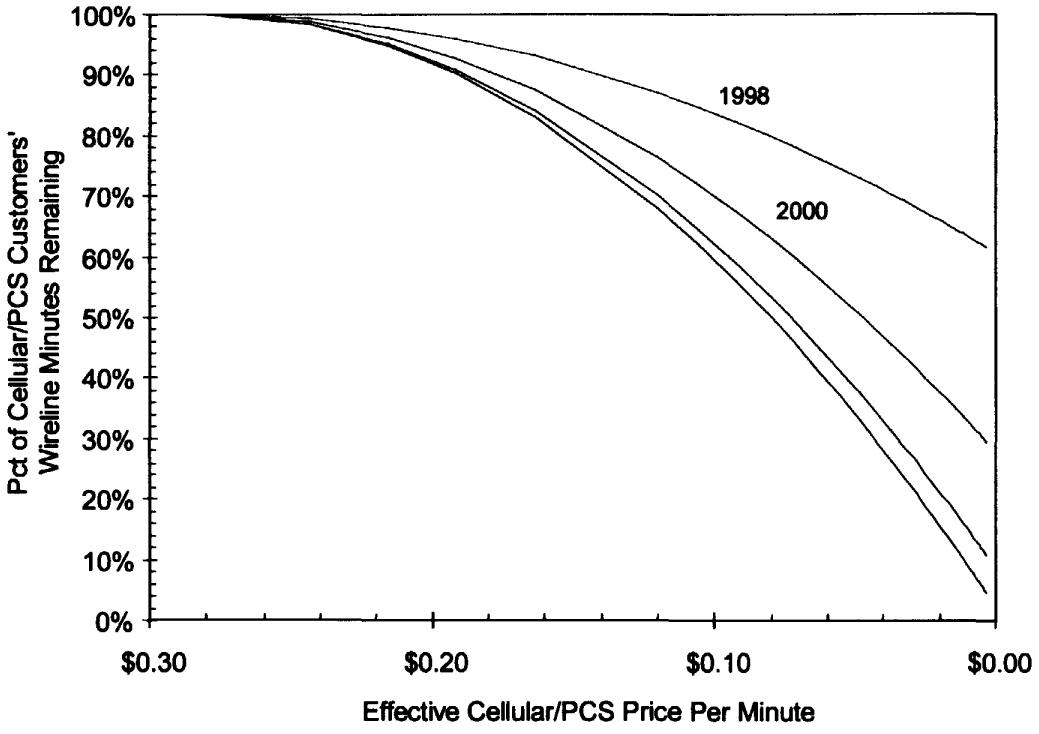
Model with Time Lag

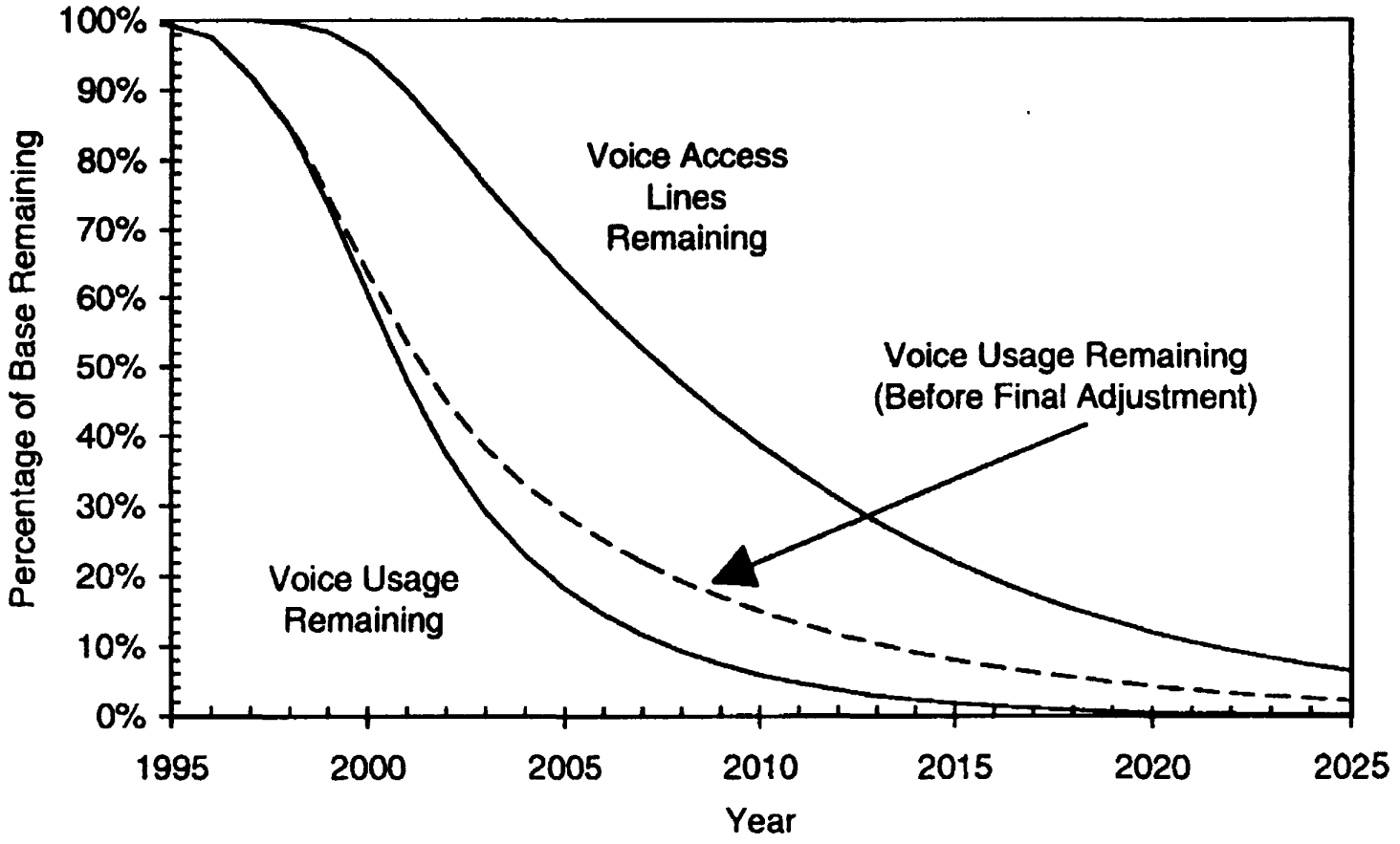


- Today—35% of base model
- 2002—90% of base model
- 2004—98% of base model

Source: Technology Futures, Inc. (Exhibit 3.3B)

TECHNOLOGY FUTURES INC

Wireline Voice Usage and Access Lines Remaining from Cellular/PCS Customers



Source: Technology Futures, Inc.

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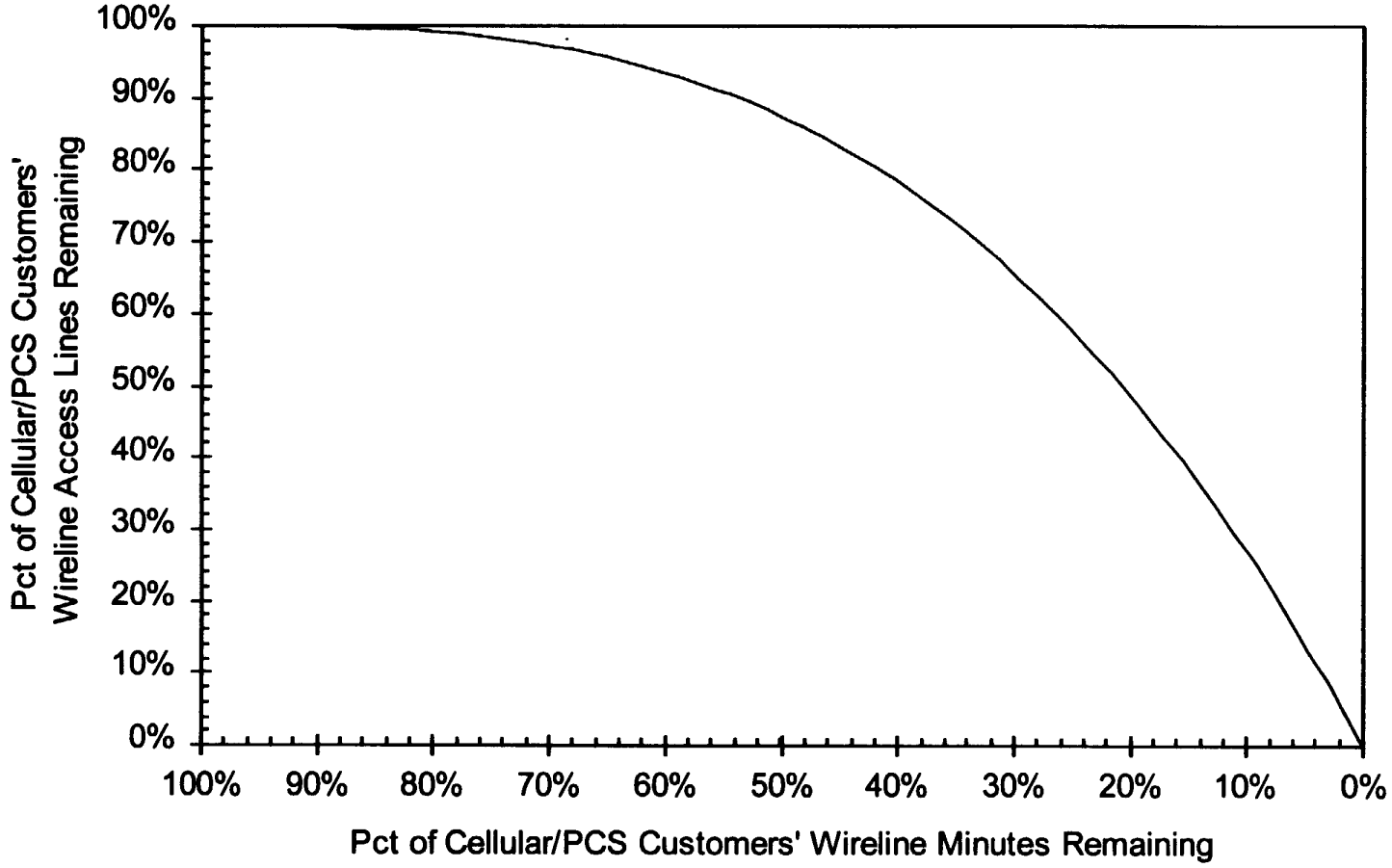
Relationship Between Lost Minutes and Lost Access Lines



Source: Technology Futures, Inc.

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Growth of Data Access Lines

- Low-speed, shared (voice and data)
- Low-speed, second line
- High-speed (service at 1.5 Mb/s and above)

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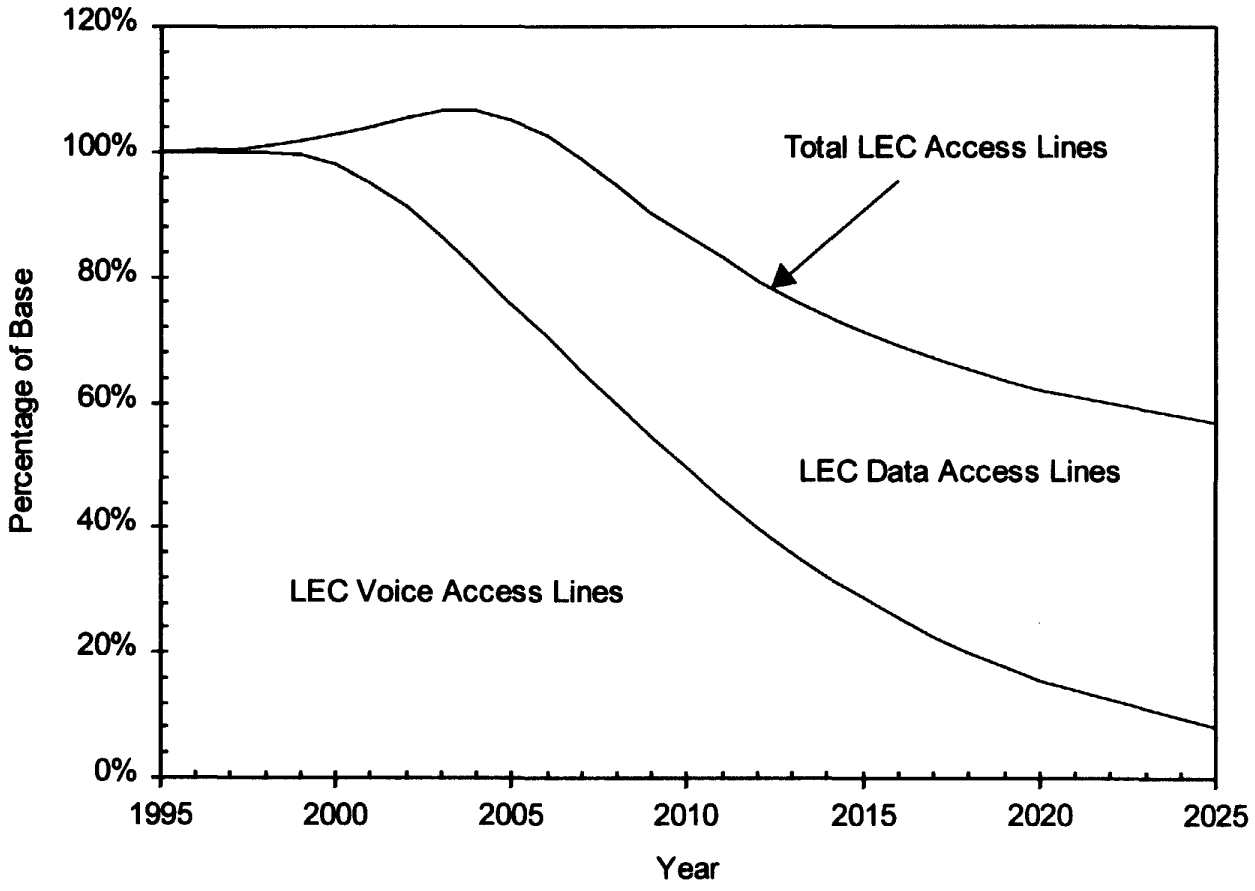
LEC Wireline Access Lines



Source: Technology Futures, Inc.

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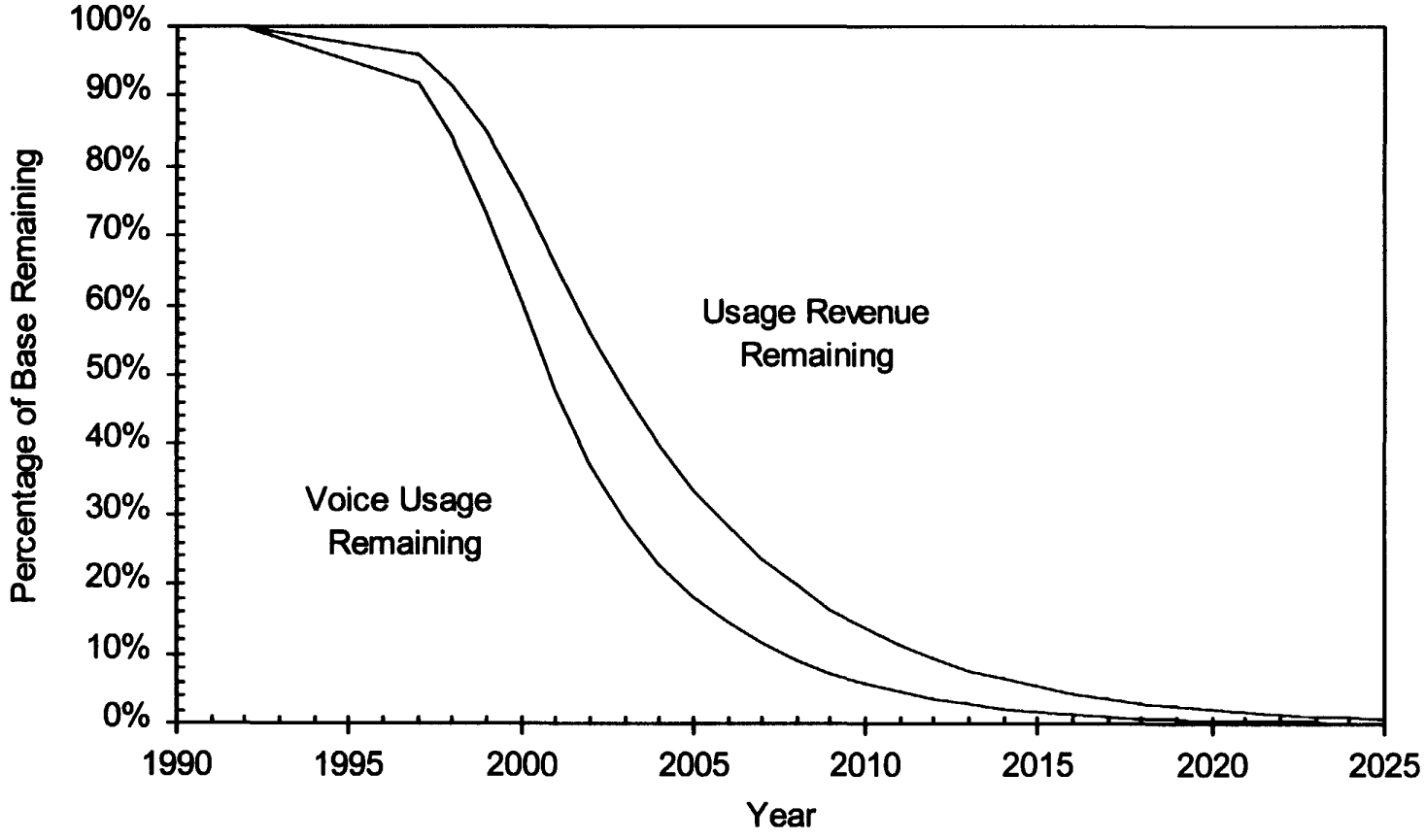
Voice Usage Revenue Remaining from Cellular/PCS Customers



Source: Technology Futures, Inc.

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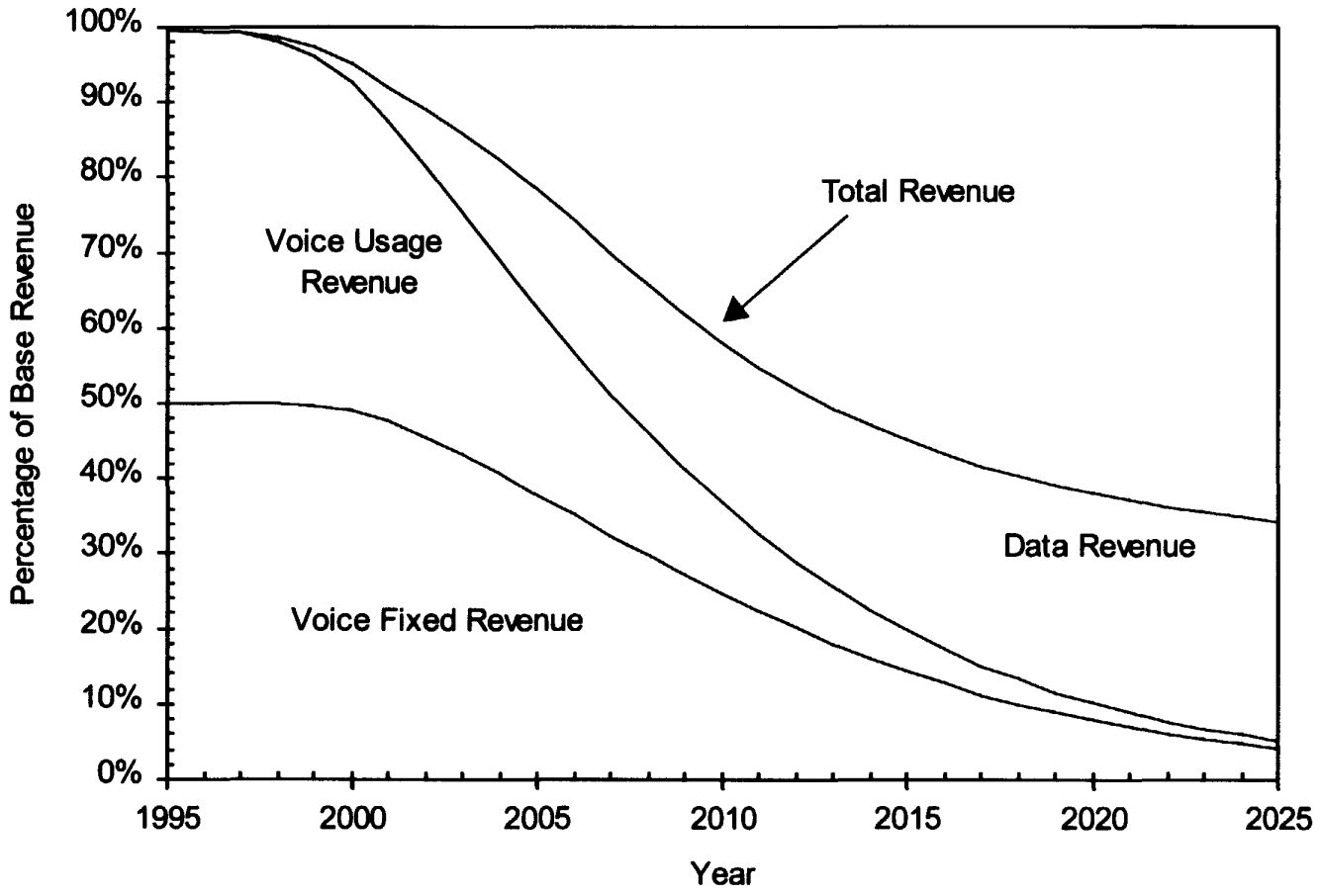
Total Base Revenue Remaining



Source: Technology Futures, Inc.

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3 *Middle Fiber*

1	*2*	*3*	*4*
ARL=	7.7	9.4	**6.6**

(Years, as of 1/1/98)

Survivors from 1/1/98

Year End	Cash Flow	Copper Cable	Combined
1997	100%	100%	100%
1998	98%	100%	98%
1999	95%	99%	94%
2000	90%	97%	87%
2001	84%	94%	79%
2002	77%	90%	69%
2003	69%	84%	58%
2004	62%	75%	46%
2005	53%	65%	34%
2006	44%	53%	23%
2007	30%	41%	12%
2008	15%	31%	5%
2009	1%	23%	0%
2010	0%	15%	0%
2011	0%	9%	0%
2012	0%	6%	0%
2013	0%	3%	0%
2014	0%	2%	0%
2015	0%	1%	0%
2016	0%	0%	0%
2017	0%	0%	0%
2018	0%	0%	0%
2019	0%	0%	0%
2020	0%	0%	0%

Source: Technology Futures, Inc.

Wireline Cash Flow Depreciation Model

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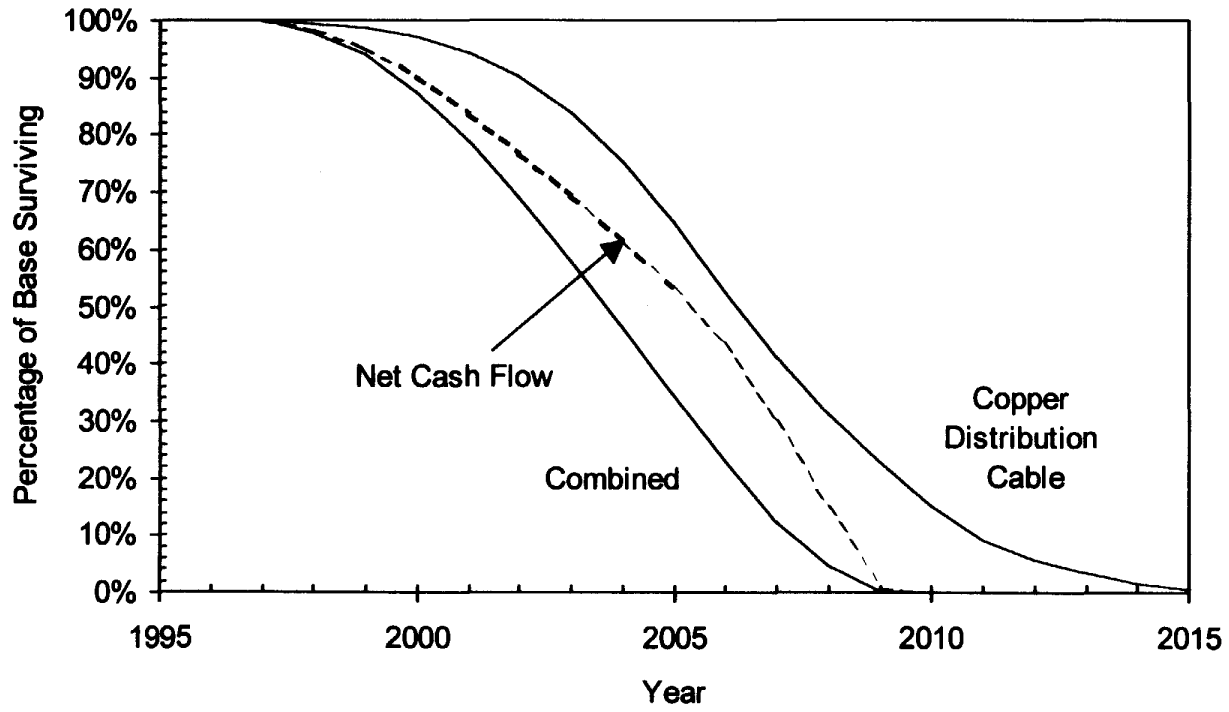
Cash Flow-Based Depreciation Model—Percentage of Base Surviving



Source: Technology Futures, Inc.

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Summary

- There is a rigorous methodology for forecasting technology change
- It is applicable to economic life estimation
- It has a proven track record
- It is superior to traditional methods when technology obsolescence is important
- It's the industry gold standard for economic lives
- Studies are documented

TECHNOLOGY FUTURES INC

LAWRENCE K. VANSTON, PH.D.

President

Technology Futures, Inc.

Dr. Lawrence Vanston is an internationally recognized authority in the use of technology forecasting in the telecommunications industry. As president of Technology Futures, Inc., Dr. Vanston has been monitoring, analyzing, and forecasting telecom technologies and services for more than 20 years. His research reports and forecasts are used and referenced extensively by telecom managers and professionals worldwide. As an expert on the impacts of new technologies and markets on the public telephone network, he is frequently called upon to testify before state and federal regulatory commissions.

Since 1985, Dr. Vanston has been the director and principal author of a number of ongoing reports commissioned by the Telecommunications Technology Forecasting Group (TTFG), which is comprised of Bell Atlantic, Bell Canada, BellSouth Telecommunications, Cincinnati Bell, GTE Telephone Operations, Sprint-LTD, and U S WEST Communications. Topics have included Internet access requirements, xDSL technologies, ATM switching, fiber optics, video services, and wireless communications. Most recently, the provocative TTFG report entitled *Wireless vs. Wireline for Voice Services: Forecasts and Impacts* has drawn widespread industry attention

Dr. Vanston's views and the results of his research are regularly cited by general business and industry publications including the *Wall Street Journal, Telephony, America's Network, Wired, Lightwave, Wireless Systems Design,* and *Communications News.* The September 21, 1998 issue of *The Wall Street Journal* contained an in-depth interview with Dr. Vanston entitled "Consultant's Call: Lawrence Vanston Makes Some Pretty Bold Predictions for the Future of Telecommunications. He Has Been Right Before."

Dr. Vanston is also a popular speaker on the subject of the future of telecommunications and its significance to organizations and people. He recently served as keynote speaker at the Global Business Forum and has spoken at such prestigious programs as the Pacific Telecommunications Conference, the International Engineering Consortium's ComForum, SUPERCOMM, the Brazil Telecom Summit, and USTA's Capitol Recovery Seminar. Attendees of the 1993 National Telecommunications Forecasting Conference (now International Communications Forecasting Conference) honored Dr. Vanston as Outstanding Speaker of the Year. In addition, he directs the popular ongoing TFI business seminar, *Technology Forecasting for the Telecom Industry.*

Before joining Technology Futures in 1984, Dr. Vanston spent four years with Bell Labs and Bellcore in network planning where he proposed and evaluated potential new long distance, billing, access, and data services. Prior to that, he was with the Texas Petroleum Research Committee and the Center for Energy Studies at the University of Texas at Austin. His academic achievements include a B.A. in government (1975) and an M.S. (1977) and Ph.D. (1979) in operations research and industrial engineering, all from the University of Texas at Austin.

Attachment A

DOCUMENT OFF-LINE

This page has been substituted for one of the following:

o An oversize page or document (such as a map) which was too large to be scanned into the ECFS system.

o Microfilm, microform, certain photographs or videotape.

● Other materials which, for one reason or another, could not be scanned into the ECFS system.

The actual document, page(s) or materials may be reviewed by contacting an Information Technician. Please note the applicable docket or rulemaking number, document type and any other relevant information about the document in order to ensure speedy retrieval by the Information Technician.

One copy of a 270 page book entitled "Transforming the Local Exchange Network".